The Georgian Bay Canal

Abstract of leading Facts and Figures :: from the :: Report of the Government :: Surveys ::

Foreword

At an approximate cost of $750,000 exhaustive surveys for the Georgian Bay Canal have been made by the Dominion Government. There has also been issued a report of over 600 pages, accompanied by nearly 60 large lithographed maps, plans, etc., giving sites and particulars of proposed structures, the whole constituting one of the most important publications preliminary to construction of a public work hitherto made by the Canadian Government.

As the valuable information therein contained must under ordinary circumstances continue to be inaccessible to the great mass of the public, it has been thought advisable to arrange a few of the leading and more important facts in compact form for ready reference. The following pages are the result.

For purposes of comparison notes and an appendix have been added. These appear in black type.

The Georgian Bay Canal

Abstract of Leading Facts and Figures from the Report of the Government Surveys

CONCLUSIONS.

Cost of 22-ft. waterway for the largest lake boats, $100,000,000.

Time of construction, 10 years.

Annual cost of maintenance, including operation of storage reservoirs for regulating flood waters of Ottawa River, $900,000.

Distance from Montreal to Georgian Bay, 440 miles.

No international waters affected.

Season of navigation, 210 days.

Time required for passage of lake freight boat of 12-mile maximum speed, from Montreal to Georgian Bay, 70 hours.

Damages:—Reaches will be held at about ordinary high water level, and no extensive damages to farming districts will occur.

Waterpowers:—A reliable waterpower supply amounting to 1,000,000 H.P. will be secured.

The Georgian Bay Canal is essentially a river and lake canalization scheme, and utilizes natural waterways existing in practically a continuous line from Georgian Bay to Montreal.

A straight line through Montreal and Sault Ste. Marie has a direction almost due east and west, and follows closely the Ottawa River and Lake Nipissing waters, giving the most direct and shortest route from Lake Superior to a sea-port.

Of the distance of 440 miles of projected navigation between 410 and 420 miles follow the course of some lake or river. For the whole route the aggregate length of artificial waterways is astonishingly small, being estimated at 28 miles.

The project involves:—

The construction of 28 miles of artificial waterway.

The improvement by dredging or excavation of 80 miles of river and lake beds.

332 miles of natural waterway, wider than 300 feet and over 22 feet in depth require no improvement.

GENERAL CHARACTER AND DESCRIPTION OF ROUTE.

From Georgian Bay to the Ottawa watershed, 81 miles, the French River and Lake Nipissing are followed.

From Lake Nipissing through the height of land the route is an artificial waterway 3½ miles in length.

This cut leads into Trout, Turtle and Talon Lakes, which form 21 miles of the route.

A canal of 3 miles from Lake Talon leads to the Mattawa River. After following the Mattawa to its mouth, a distance of 13 miles, a canal ¾ of a mile long gives entrance into the Ottawa River.

The Ottawa expands into large and deep lakes in many places, and is followed to the foot of Lake of the Two Mountains, a distance of 293 miles.

Entrance to the St. Lawrence may be either through Lake St. Louis or via the Back River.

THE OTTAWA RIVER.

Has a basin of 56,043 miles, and is 750 miles in length. Of the total area of the basin about four-fifths is drained by the northern, and about one-fifth by the southern tributaries.

The river is generally a series of deep and wide basins connected by restricted parts which are broken up by falls and heavy rapids.

The discharge of the Ottawa varies largely, but there are no sudden variations and the freshets come only once a year, always at about the same time.

The northern part of the Ottawa Valley is remarkable for the great number of its lakes, offering great possibilities for the storage of water.

An important feature of the project is the utilization on a large scale of these natural reservoirs to regulate the flow of the river to the great benefit not only of navigation, but of industries along the route.

The Ottawa is now navigated from Ottawa to the St. Lawrence River, the available depth of the canals at Grenville, Carillon and St. Anne's being about 7 feet.

The principal portion of the traffic, which in 1907 was 337,850 tons, consists of lumber in various forms. From 200 to 350 barges come up every year and carry from 30 to 50 million feet of lumber annually to Montreal, Lake Champlain, and other ports.

The country along the North Shore is rich in minerals. Important deposits of mica, felspar, apatite, graphite, etc., are found. Iron also occurs and has been mined to some extent. Granite and other quarries are worked with profit, and the extensive cement industry situated in Hull, Que., would be a heavy contributor of traffic.

Through navigation is interrupted by the Chaudière Falls at Ottawa, but several stretches above are navigable. These are the Deschenes Lake, Chats Lake, Lake Coulonge, Allumette Lake, and the stretch between Pembroke and Des Joachims.

THE MATTAWA RIVER

rises in the chain of lakes known as Talon, Turtle and Trout, which form part of the waterway, is about 32 miles in length, and has a drainage basin of 880 square miles. The total fall from Trout Lake to the Ottawa River is 180 feet.

The portion of the river utilized for the waterway is 13 miles in length, including Lake Plain Chant, a body of water 5½ miles long, very deep, lying between two ranges of hills which are very precipitous, and which is of sufficient width at any part at the present time for navigation purposes.

LAKE NIPISSING

Is a large body of uniformly shallow water having an area of about 320 square miles, and draining a basin of 4,077 square miles. The shores in many places are low, and it cannot be maintained much above high water level without flooding a considerable area. The extreme fluctuation of the lake is about 8 feet, and no difficulty is anticipated in regulating its level at any elevation near its high water stage.

THE FRENCH RIVER

Has a basin of 907 square miles, a high water discharge of 12,000 to 14,000 cubic feet per second, and an extreme low discharge of 3,000 cubic feet per second. From Lake Nipissing to Georgian Bay, a distance of 63 miles, the fall is 62 feet.

For the first twelve miles it has an average width of half a mile and a depth of 40 feet and over, and is often called the Southwest Arm of Lake Nipissing.

Its course is a succession of wide and deep expansions and narrows between high granite walls.

French River harbour has an average width of about 500 feet with a depth of about 30 feet. The Bustard Islands, 3 miles from the mouth of the harbour, offer good protection against southerly winds.

The Georgian Bay is remarkably free from fog, the average being not over four days in any month.

CHANNELS.

Minimum depth, 22 feet.

Least bottom width of submerged channels, 300 feet.

Least width of canal cuts, 200 feet.

The minimum depth of 22 feet will more than equal conditions in the channels governing the draft of boats on the Great Lakes, viz: St. Mary's River, St. Clair

Flats canal, and the Detroit River.

Taking into account 14⅓ miles which after removal of obstructions will have free, wide channels, the route may be sub-divided as to width as follows:

Canal cuts, 200 to 300 feet wide, including necessary restrictions at locks...........	28 miles.
Improved channels, submerged sides, 300 feet wide	66 "
Free channels 300 to 1,000 feet wide and over	346 "
Total	440 miles.

(The description of the proposed waterway, as a "Canal" is a misnomer. The method of improvement proposed consists generally, of raising existing water-surfaces so as to form a series of 23 lake-like reaches of practically slack-water between Montreal and Georgian Bay confined by the natural river banks, and connected by locks. What is described as 28 miles of canal, consists chiefly of the locks themselves and their long approaches. Thus of the 346 miles of free channels over 240 miles will have a width of 1,000 feet and over.)

Sides of all submerged cuts will be shewn by piers at suitable distances. Along curves these piers will be provided with lights, and each different course will be defined by ranges.

Restricted channels are widened at all bends, and conditions for navigation in these restricted parts will be as good as on the St. Mary's, St. Clair and Detroit river channels.

The curves which occur in dredged portions are nearly all over a mile radius.

The St. Mary River, 50 miles long from the Soo down to Detroit on Lake Huron, has been navigated for years with extremely few accidents, by thousands of lake boats, meeting one another both day and night, in clear weather fogs and snow storms. The Ottawa channel is in all respects equal to this stretch.

LOCKS.

Will be 27 in number.

Minimum dimensions to be 650x65 feet and 22 feet deep.

Total lockage, 758 feet.

Rise from Montreal to Summit, 659 feet, to be overcome by 23 locks.

Descent from Summit to Georgian Bay, 98 feet, to be made by 4 locks.

(Locks on Welland and St. Lawrence route, 48; on Ottawa route, 27. Miles of canal, via Welland and St. Lawrence, 73¼; via Ottawa route, 28.)

To be constructed of concrete with long approach piers, generally extending 2,000 feet above and below each lock.

All locks will be on secure rock foundations, and can be built under the best possible conditions of safety and stability.

Steel gates have been designed for the canal by Mr. Henry Goldmark, C.E., who designed the gates for the Panama Canal.

For safety, duplicate pairs of gates are provided at both ends of the locks, and should a larger chamber be required occasionally a clear length of 707 feet would be available by leaving the inner pair of the lower gates open.

The locks as designed, however, will accommodate a lake freight steamer of modern type 600 feet long with 60 foot beam, carrying 12,000 tons on a draft of 20 feet, and having a capacity of 400,000 bushels of wheat, equivalent to 400 cars of 30 tons capacity each, or ten trains of 40 cars each.

Increased depth up to 26 feet can be secured temporarily by filling the reaches above ordinary working level and in case of emergency will pass boats of 24 to 25 foot draft.

All locks will be electrically operated and lighted, and electric lighting provided for lock approaches and restricted channels, as well as a complete system of telephone communication along the route and to the storage reservoirs. All operating plants to be duplex in every feature and so arranged as to allow of four combinations for operation in case of a breakdown of one of their parts.

Cost per cubic yard of the Georgian Bay Canal locks as designed will be less than one-third that of their prototypes at the Sault.

	Length of Canals.	No. of Locks.	Lockage.
Welland and St. Lawrence....	73.37	*49	552.2
Georgian Bay Canal	27.50	27	+758

(*Even if 7 locks of 47 feet lift each could be substituted for the present 26 locks on the Welland, there would be 33 locks on the St. Lawrence route as against 27 on the Georgian Bay Canal, or 25 if the Lake Nipissing summit level is adopted.

+Lockage on the Georgian Bay Canal would be reduced to 700 feet by adoption of the Lake Nipissing summit.)

DAMS.

Total number, 45.

Rock-fill dams will be used on the Ottawa River section, a great advantage of this type of dam on a river of large flow, like the Ottawa, being its absolute safety under all conditions.

Where conservation of water is involved water-tight concrete dams are provided for.

Eighteen main dams will be required, all on rock foundations. The highest above low water level will be 25 feet.

Total height from bottom in deepest part of river to crest level, 80 feet.

The watershed tributary to the ship-canal furnishes ideal opportunities for effectual control for all portions of the river.

The French and Ottawa Rivers are generally a series of deep lake-like expansions separated by rapids and falls. The general system of improvement proposed is the construction of dams at the head of these rapids to retain the water at prescribed levels in the different reaches.

On the upper Ottawa the permanent improved level will be much above ordinary high water level, but in general the reaches will be maintained at about present high water level.

The spring flood in the Ottawa River can be restrained so that under extreme conditions the reaches will not overflow. Currents in the reaches will not be over 3 miles per hour, that is to say, practically slack water navigation will obtain throughout.

STORAGE RESERVOIRS AND FLOOD REGULATION.

The ideal waterway for safe and economical navigation has unrestricted channels of slack water.

The question of controlling the flow of the rivers utilized and thus creating a practically slack water navigation is therefore of vital importance, and is one of the necessary elements of the project.

The watershed tributary to the canal furnishes ideal opportunities for effectual control for all portions of the river.

Sufficient storage reservoirs have been located to control the flow at a stage at which it will create no currents dangerous to navigation.

Other reservoirs of large size are known to exist in the unsurveyed and unexplored territory. The determination whether these additional reservoirs are to be built or otherwise is one entirely of cost, each new reservoir reducing the cost of the locks and dams, but increasing the storage cost.

Storage reservoirs have been located as follows:—

Dam at foot of Lake Temiskaming, 240 miles above Ottawa, 1,100 feet long, will retain a reserve of water of 125 square miles in area and 8 feet in depth. Capacity, 27,878,400,000 cubic feet.

(This dam is now under construction.)

Gordon Creek and Kippewa Lake—

Area of reserve, 110 square miles, 6 feet in depth.

Capacity, 18,399,744,000 square feet.

Quinze Lake—

Area 96 square miles with depth of 5 feet.

Capacity, 13,381,632,000 cubic feet.

THE HARBOUR FRONT, MONTREAL
Eastern Terminus of proposed National Waterway the Georgian Bay Ship Canal

Barriere River—

Area 35 square miles with depth of 10 feet.

Capacity, 9,757,440,000 cubic feet.

Ottawa River above Lake Expanse—

Area 25 square miles, 10 feet deep.

Capacity, 6,969,600,000 cubic feet.

Askikwaj Lake—

Area 48 square miles, 10 feet deep.

Capacity, 23,603,712,000 cubic feet.

Grand Lake Victoria—

Area 150 square miles, 8 feet deep.

Capacity, 33,454,080,000 cubic feet.

Turn-Back Lake—

Area 48 square miles, 10 feet deep.

Capacity, 13,381,632,000 cubic feet.

Total capacity of proposed reserve dams on the Upper Ottawa, 146,828,240,000 cubic feet.

Total cost of reservoir system is estimated at $2,000,000.

Advantages of storage of surplus waters will be:—

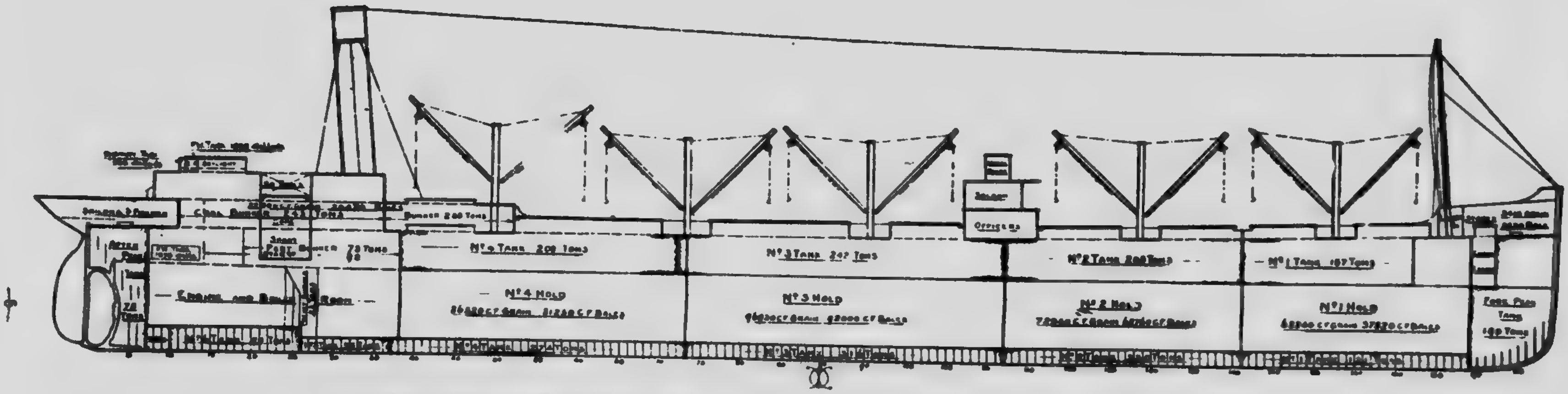
1. Reduction of flooded areas.
2. Great reduction in cost of construction.
3. Reduction of velocity of currents, and creation of practically slack-water navigation along the entire route.
4. Increase of efficiency of powers for industrial purpose.
5. By eliminating extreme high and low water will materially assist lumbering operations.
6. As low water level at St. Anne can be increased over 2 feet, this, it is estimated, would raise the low water level in Montreal Harbour one foot.

The advantages, aside from navigation, which will be gained by the proposed system of control of the Georgian Bay Canal route, would of themselves pay for the construction of a large part of it.

A prominent example of a reservoir system, much smaller than that proposed for the Ottawa, benefitting industries, is that of Minneapolis. In the reports of the United States Chief of Engineers it is stated that the reservoir system has already directly benefitted the milling industries of Minneapolis to the extent of $500,000 annually, the production of flour by water-power amounting to 16,000,000 bbls. at less than one cent a barrel, which by steam would cost 5 cents.

SUMMIT LEVEL AND WATER SUPPLY.

The Summit Level of the proposed waterway extends from Lake Nipissing to the head of the Mattawa River, embracing Trout Lake, the Little Mattawa River, Turtle and Talon Lakes, a distance of about 25 miles.



Plan of S.S. Fritzoe, specially built for carrying Nova Scotia coal on the St. Lawrence, and adapted to the trade through the proposed Georgian Bay Ship Canal

Length, 360 feet beam, 51 feet; capacity on 20 ft. draught, 5,500 tons—183,333 bushels of wheat—equivalent to 183 car-loads of 60,000 lbs. each; capacity of bunkers 715 tons; consumption of coal per day, 30 tons. Speed, loaded, 11 knots (12.65 miles) per hour. Time from Sydney to Fort William, 7 days and 9 hours.

The height of land proper separating the waters of the Great Lakes and those of the Ottawa River, occurs between Lake Nipissing and Trout Lake, the latter being the highest body of water on the route. The granite ridges forming the divide is in many places very little above the waters of Trout Lake.

The respective elevations of the summit lakes above sea level are:—

Lake Nipissing,	mean level	 640	feet.
Trout Lake	"	 663	"
Turtle Lake	"	 662	"
Talon Lake	"	 635	"

A summit level may be established by raising Trout, Turtle and Talon Lakes to elevation 677 feet, and lifting vessels from Lake Nipissing to that level by a lock.

This plan involves the determination of a sufficient water supply for operation of the locks.

With the adopted grade, the open stretches of the summit are singularly wide and deep, and will allow of full speed over almost its entire length.

The water available is more than sufficient to supply the summit, were the locks to be doubled, and each the size of the Canadian Ship Canal at Sault Ste. Marie.

With locks of the proposed size and lift, it is calculated that the average quantity of water required, based for the entire season on alternate lockages, east and west, will be 1,869.563 cubic feet per passage of the Summit, or 21.63 cubic feet per second, say 22 cubic feet.

In a minimum year of supply, 435 cubic feet at least are available from inflow and storage, representing practically 20 lockages a day, and a time interval of one hour, 12 minutes.

The expedient may be resorted to for the Summit locks of placing intermediate gates, and using a smaller chamber for locking small vessels, thereby saving a large quantity of water, and increasing the number of lockages to 25.

The limiting capacity of the waterway may be determined by assuming the time interval between lockages at a minimum, say 45 minutes, representing an average of 32 lockages per day.

During the period of deficient flow an additional 700 cubic feet per second can be obtained by diversion, at a cost of $980,000, thereby meeting all demands of a maximum traffic.

(This additional supply gives a total of 1,135 cubic feet per second, representing 51 lockages a day. In 1907, when the traffic at the Sault amounted to 58,000,000 tons, the average number of lockages per day through the Poe lock was 24, and through the Canadian lock 19, or a total of 43 lockages per day for both locks. It will be seen, therefore, that an ample water supply for any possible traffic is fully assured.)

An alternative plan proposed for establishing a summit level is to lower Trout, Turtle and Talon Lakes to the high water level of Lake Nipissing, making elevation 648 the governing level.

(This plan makes the whole drainage basin of Lake Nipissing tributary to the summit, thus creating a summit reach 58 miles in length, absolutely ensuring the water supply for all time to come, decreasing the total lockage by 58 feet, and doing away with two locks, thereby reducing cost of maintenance and operation. On the other hand it adds considerably to cost of construction.)

TIME OF TRANSIT.

70 hours from Georgian Bay to Montreal.

1 to 1½ days faster than any other existing water route under present conditions from head of Great Lakes to ocean port, apart from also having an enormous superiority as to carrying capacity.

As there will be practically no current, boats should make equally as good time in the river reaches as in the dredged channels of the St. Mary's River, viz: 9 miles per hour and 6 miles per hour in canal.

(Many lake and river reaches will be navigated at full speed.)

LENGTH OF NAVIGATION SEASON.

Will be governed by opening and closing of navigation on Lake Nipissing and by conditions at the Summit and Mattawa River reaches.

Average dates of opening and closing of navigation and number of days open, 1880-1907.

	Opening.	Closing.	Days Open.
Sault Canals	Apr. 23	Dec. 9	230
French River Harbour	Apr. 26	Dec. 3	221
Lake Nipissing	Apr. 27	Dec. 4	221
Lower Ottawa Canals	Apr. 29	Nov. 29	214
Ste. Anne Lock	Apr. 25	Nov. 27	216
Lachine Canal	Apr. 30	Dec. 1	215

Average date of first arrival from sea, Montreal Harbour, in last 21 years ....April 24

Average date of last departure for sea ....Nov. 25

Average days Montreal Harbour open for ocean navigation 215

In order to eliminate all possible chance of over-estimation, the navigation season on Lake Nipissing is reduced from 221 to 211 days, and this is assumed to be the length of time the waterway will be open for navigation, practically the same as the season for ocean navigation for the Harbour of Montreal, which governs the water-borne import and export trade through the St. Lawrence River route.

TIME OF CONSTRUCTION.

Careful analysis of the work to be performed shows that it would take from 3 to 5 years to develop all con-

tracts and place the whole route under active construction. Some of the sections where heavy submarine excavation is encountered would require five years to complete. It may be fairly stated therefore that a period of ten years from inception would be necessary to open the waterway to navigation. This would mean an average expenditure of about $10,000,000 a year.

TIME OF PASSAGE OF LOCKS AND APPROACHES.

The Canadian lock at Sault Ste. Marie resembles more closely in all its features the type of lock and approaches designed for the Georgian Bay Canal than any other existing structure.

Comparison between them may be made as follows:—

			Depth on Sills.		
	Length	Width	Upper	Lower	Lift
Lock—	Ft.	Ft.	Ft.	Ft.	Ft.
Sault	900	60	22.2	20.3	18
Georgian Bay Canal..	650	65	22	22	10 to 50

Actual times of recorded passages at the Sault are as follows:—

Steamer	Reg. Tonage Tons	Cargo Tons	Time of L'k'ge		Approaches			Av. Sp'd Miles per hr.
			Min.	Sec.	Distance Ft.	Time Min.	Sec.	
Turret Cape	1148	Light	17	[illegible]	4530	6	30	7.9
Juniata ...	2619	1747	19	20	4530	8	5	6.3
H. S. Holden	3091	7616	28	48	4680	19	25	3.3
J. H. Bartow	5021	9500	32	45	6400	26	40	2.6
J. Sellwood.	5269	9000	46	40	4530	19	30	2.6

DISTANCES,

Chicago is 412 miles nearer to Montreal via the Georgian Bay Canal than to New York by the Erie Canal route, and 794 miles nearer to Liverpool than by the American waterway.

Duluth is 424 Miles nearer to Montreal by the Georgian Bay Canal than to New York by the Erie Canal route, and 806 miles nearer to Liverpool.

It is only 83 miles farther from Chicago to Montreal via the Georgian Bay Canal than from Chicago to Buffalo.

It is only 71 miles farther from Duluth and Fort William to Montreal via the Georgian Bay Canal than from the same ports to Buffalo.

From all ports on Lakes Huron, Michigan and Superior the Georgian Bay Canal route to Montreal is shorter than the St. Lawrence and Welland route, as shown by following comparative table.

Miles to Montreal from	via. St. L. & Welland.	via. G.B. Canal.	Difference in favour of G. B. Canal.
Sarnia	675	677	...
Goderich	738	614	124
Kincardine	771	581	190
Southampton	798	554	244
Owen Sound	921	539	382
Collingwood	939	550	389
Midland	946	549	397
Victoria Harbour	947	550	397
Depot Harbour	922	515	407
Chicago	1,242	972	270
Sault Ste. Marie	943	661	282
Fort William	1,216	934	282
Duluth	1,338	1,056	282

ESTIMATES OF COST.

Summary.

1. Via Lake St. Louis route—

Locks, dams, channels, piers, lighting, damages, etc.	$88,626,108
Contingencies, engineering, etc., 10%	8,862,892
Storage of flood waters, etc.	2,200,000
Total	$99,689,000

2. Via Back River route—

Locks, etc.	$83,354,508
Contingencies, etc.	8,335,492
Storage, etc.	2,200,000
Total	$93,890,000

Estimated reduction of cost by adopting Back River route at Montreal	$5,797,000
Cost of feeder at Summit, when required	$987,485

Locks 800 feet long and 75 feet wide would increase the total cost by $5,000,000.

Building all locks 24 feet deep so reaches might afterwards be deepened, would add $6,000,000 to the cost.

The adoption of the Lake Nipissing summit level, while it would reduce the lockage by 50 feet and do away with two locks and thus lessen cost of maintenance and operation, is estimated to cost $9,625,000 more than the higher summit.

	Miles.	
Montreal	0— 5	$3,859,000
Lake St. Louis	5— 25	12,553,000
Oka	25— 49	2,334,000
Pt. Fortune	49— 60	3,860,800
Ottawa	60—121	6,169,800
Hull	121—122	2,323,800
Aylmer	122—154	5,599,100

	Miles	
Arnprior	154—174	2,745,600
Portage du Fort	174—187	2,032,300
Rocher Fendu	187—190	481,800
Coulonge	190—209	3,940,400
Pembroke	209—265	4,400,200
Des Joachims	265—284	2,725,583
Rocher Capitaine	284—296	3,917,900
Deux Rivières	296—318	2,470,421
Mattawa	318—320	1,505,525
Plein Chant	320—326	1,453,592
Les Epines	326—331	1,379,940
Lower Paresseux	331—333	2,523,136
Summit	333—358	8,373,467
Nipissing	358—390	3,302,267
Five Mile Rapid	390—403	3,162,853
Pickerel River	403—442	6,511,624
		$88,626,108

Estimated cost of

Locks	$26,977,926	30%
Dams and regulation	6,057,533	7%
Channels	48,706,779	55%
Damages	6,883,870	8%
Total	$88,626,108	

Details of Cost—

Rock excavation, submarine	$23,982,780
Rock excavation, dry	19,587,750
Earth excavation, wet	2,140,073
Earth excavation, dry	3,223,690
Concrete and masonry	14,307,322
Rock and earth fill and bank lining	5,663,254
Crib-work and timber	6,305,591
Stop-logs and machinery	1,849,680
Steel lock gates	2,610,106
Equipment and power	875,920
Unwatering	354,976

Quantities—

Total rock excavation, submarine	8,322,554	c. yds.
Total rock excavation, dry	18,574,496	"
Total earth excavation, dry	10,836,537	"
Total earth excavation, dredging	8,935,667	"
Concrete	1,901,957	"
Granite masonry	2,474	"
Rock fill	8,390,740	"
Bank lining	114,300	"
Earth fill	3,770,078	"
Crib work	1,910,102	"

Unit Prices—

Excavation, $1.00 and $1.10 per cubic yard for rock.

Excavation, 25 to 35 cents per cubic yard for loose material.

Concrete, $7.50 per cubic yard.

Crib work, $3 to $3.50 per cubic yard.

Structural Steel, $120 per ton.

Submarine Rock Excavation, $3 to $3.50 per cubic yard.

Lining Banks with Stone, $2 per cubic yard.

Guide Cribs along Submerged Channels, $3 per cubic yard.

MAINTENANCE AND OPERATION.

Operation of the canal will employ 24 lockmasters, 42 electricians, 102 lock motormen, 24 electric linemen, 198 boat linemen, 40 sluice attendants, 44 bridge motormen, 24 launches with 50 men for upkeep of lighting system, and about 200 men for operation of the storage reservoir system. Also 10 tugs and crews, 5 supply boats and crews, dredges, scows, floating repair shops, etc., and an engineering staff of chief engineer and 3 assistants, 3 division superintendents, chief electrician, master mechanic, clerk of works, draftsmen, and clerks.

SUMMARY.

Cost of Engineering Staff	$38,900
Cost of Operating Staff at Locks	197,900
Cost of staff, light, sluice, and bridge tenders, etc.	70,400
Cost of Crews for Repair Outfits, etc.	186,250
Storage Reservoirs, Wages and Upkeep	90,000
Materials for Repair, Machinery, etc.	300,000

Operation and Repairs per year would then be as follows:

Operation Canal proper	$307,200
Operation Reservoir System	90,000
Repair Outfits, Materials, etc.	486,250
	$883,450 say $900,000

WATERPOWERS:

The plans proposed create at least twelve large powers which consume the entire head of the Ottawa River from Mattawa to the Lake of the Two Mountains.

Development of the powers of the Ottawa River under present conditions, except for very large initial consumption, is practically impossible.

Upwards of 1,000,000 h.p. can be developed by the improved regulated conditions proposed for canal purposes. It is doubtful if more than 150,000 h.p. could be developed at present.

On the Ottawa River, even in its present condition, the force unused is enormous.

The construction of the canal will furnish one of the principal reasons for the development of the powers by giving cheap transportation both for the raw material and the finished product.

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C.P.RY. AND C.N.RY. GRAIN ELEVATORS AND HARBOUR FRONTS OF FORT WILLIAM AND PORT ARTHUR
Western Terminus of the proposed National Waterway the Georgian Bay Ship Canal

These powers, by reason of the canal construction and the storage created at the head waters, form one of the chief features in the building of the canal, and would ultimately go a long way towards paying interest on the total cost of construction.

By the plans for the waterway, the flow with the proposed storage will be augmented at low water season, the number of available sites for powers increased, and dams constructed which are in themselves the most expensive part of the power development. But these dams are larger than a power company would undertake for development purposes only. Therefore it is clear that ultimately, owing to the construction work, the energy available will be from 15 to 20 times more valuable than it is now.

An annual rental of $5 per h.p. would result in an eventual revenue of $5,000,000 per annum.

North of the Island of Montreal, on the Back River route, there will be developed at two sites, 148,480 electrical h.p.

At Point Fortune, 50 miles from Montreal, there will be developed 148,000 electrical h.p.

At Hawkesbury, 60 miles from Montreal, 71,800 h.p.

At the Chaudiere, 127 miles from Montreal, 45,000 additional electrical h.p. will be available after the canal is constructed.

At the Chats Falls, 155 miles from Montreal, 113,500 h.p. will be available.

At Portage du Fort, 174 miles from Montreal, 68,300 h.p. will be developed.

At Rocher Fendu, 183 miles from Montreal, 78,000 h.p.

At Grand Calumet Falls, 56,000 h.p.

At Paquette, 209 miles from Montreal, 24,900 h.p.

At Des Joachims, 266 miles from Montreal, 60,400 h.p.

At Rocher Capitaine, 204 miles from Montreal, 82,000 h.p.

At Deux Rivieres, 296 miles from Montreal, 38,400 h.p.

Sectional Elevation

Plan showing modern type of Lake Freight Steamer in proposed Standard Canal Lock

Length of Steamer, 600 feet; beam, 60 feet; draught, 20 feet; capacity, 12,000 tons—400,000 bushels of wheat—equivalent to 400 cars of 60,000 lbs. capacity each, or 10 trains of 40 cars each. Speed up to 12 miles per hour. Georgian Bay to Montreal, 70 hours.

The following answers were given by Captain Norcross in charge of the Wolvin fleet of Duluth, to questions submitted by the Department of Public Works:—

Q. What do you think of the future outlook of the Ottawa route?

A. If the round trip from Port Arthur to Montreal can be made in 15 days it will completely revolutionize the transportation trade. A rate of 2 cents per bushel would be given to Montreal.

Q. What do you consider the advantages of this route as against the St. Lawrence route, both on east and west bound traffic?

A. Grain can be carried from Port Arthur through the Georgian Bay Ship Canal route at about 2 cents per bushel. In comparison, it costs about 1½ cents at an average freight rate to Port Colborne, add to this ½ cent for transfer, than allow 2½ cents freight to the 2,000 ton vessel which will have to carry it from Port Colborne to Montreal.

Captain Norcross further gives his views on transportation and rates as follows:

Taking wheat as a basis in 1905 the through sum of rate from the head of the Lakes to the sea-board via New York Central lines from Buffalo was five cents, and via canal from Buffalo, five and three-eighth cents. This is the lowest freight of the season. In the fall it went as high as ten cents via railroad lines, and ten and one-half cents via canal routes: the reason for the preferential in favour of the canal route was the assurance of no storage charges and the almost impossiblity of securing cars from the railroad lines to deliver grain to the seaboard in time to make connections with the ocean sailings. These rates include all charges against the grain except when held in Buffalo in elevators for more than ten days, then the charge is one-quarter of a cent in addition for every ten days or portion thereof. I might say here that the shortage of cars at Buffalo in the fall of the year is a very great inconvenience to the shipper on account of his not being able to always make connections with his ocean space. This would be practically eliminated if the Georgian Bay Ship Canal route was in operation. If the Georgian Bay Ship Canal were completed and capable of accommodating our largest and most modern freighters, wheat could be delivered at Montreal for two and one-quarter cents per bushel. This would be allowing the steamer a very good margin of profit. If this canal is built according to the ideas suggested to me, by the engineers, it would be possible for a steamer to make the round trip from Port Arthur, returning without cargo in fifteen days, allowing four days to discharge at Montreal.

I am strongly of the opinion that should you construct the Georgian Bay Ship Canal, the grain would only be one of a number of the products that would be benefitted. The advantages and conditions applying to grain would also apply to all through freights, east and west bound.

Appendix

For the purpose of comparison the following facts relating to the great ship canals of the world will be of interest:—

MANCHESTER SHIP CANAL

(River Mersey to Manchester.)

Length, 35½ miles.
Depth—originally 26 feet, increased to 28 feet.
Bottom width of channel, 120 feet.
Locks, 5 in number, general dimensions being: for small locks, 350 x 45 feet, for large locks 600 x 65 feet.
Cost—£17,593,230—$85,527,400.
Opened for traffic, January 1st, 1894.
Traffic and Revenue:

	Tons.	
1894	925,569	$475,793
1897	2,095,915	994,657
1900	3,060,516	1,413,433
1903	3,846,006	1,929,546
1906	4,253,354	2,184,253
1907	5,210,759	2,602,943

SUEZ CANAL

(Red Sea to Mediterranean Sea.)

Length, 99 miles.
Depth—originally 26 feet, increased in 1895 to 31 feet.
Channel's bottom width 108 feet, surface width 420 feet.
Cost, slightly over $100,000,000.
Opened for traffic in 1869.
Traffic and Revenue:

	Tons.	
1882	7,122,125	$12,325,828
1892	10,866,401	14,473,551
1902	15,694,350	20,164,388
1907	20,553,241	22,560,430

KIEL CANAL (Kaiser Wilhelm)

(North Sea to Baltic Sea.)

Length, 61 miles.
Depth, 29½ feet.
Cost, $40,000,000.
Opened for traffic June 19, 1895.
Traffic and Revenue:

	Tons.	
1900-01	4,282,258	$567,830
1904-05	4,684,976	547,000
1906-07	5,963,125	714,030

CRONSTADT CANAL

Connecting the Bay of Cronstadt with St. Petersburg is a work of great strategic and commercial importance to Russia.

Depth, 21 feet.
Opened for traffic, 1890.
Cost, about $10,000,000.
Traffic and Revenue, no data available.

Appendix

SAULT STE. MARIE CANALS

(Between Lake Superior and Lake Huron.)

Weitzel Lock, 515 feet long, 80 feet wide, and 17 feet deep. Opened 1881.

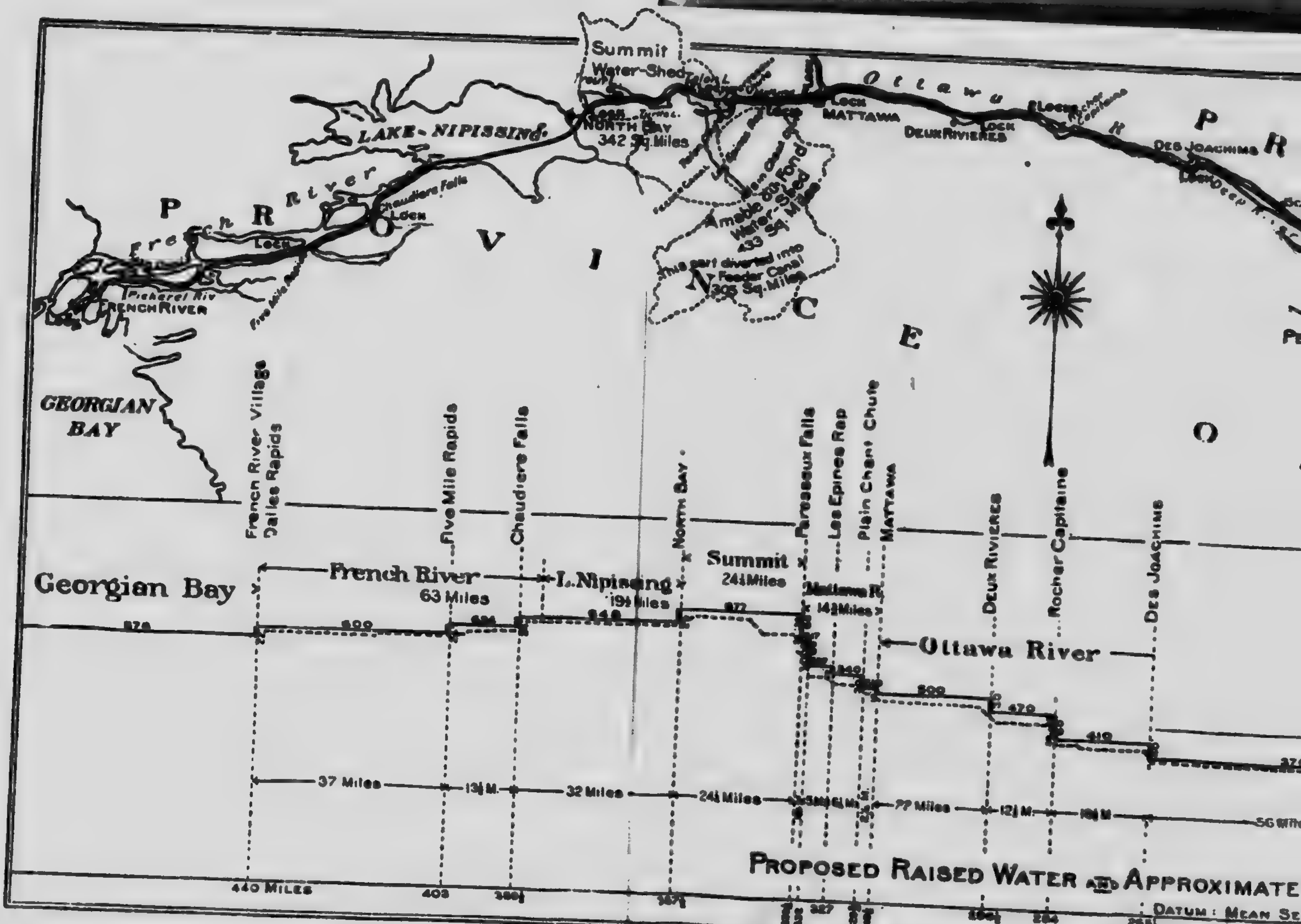
Poe Lock, 800 feet long, 100 feet wide, nominal depth 22 feet. Opened 1896.

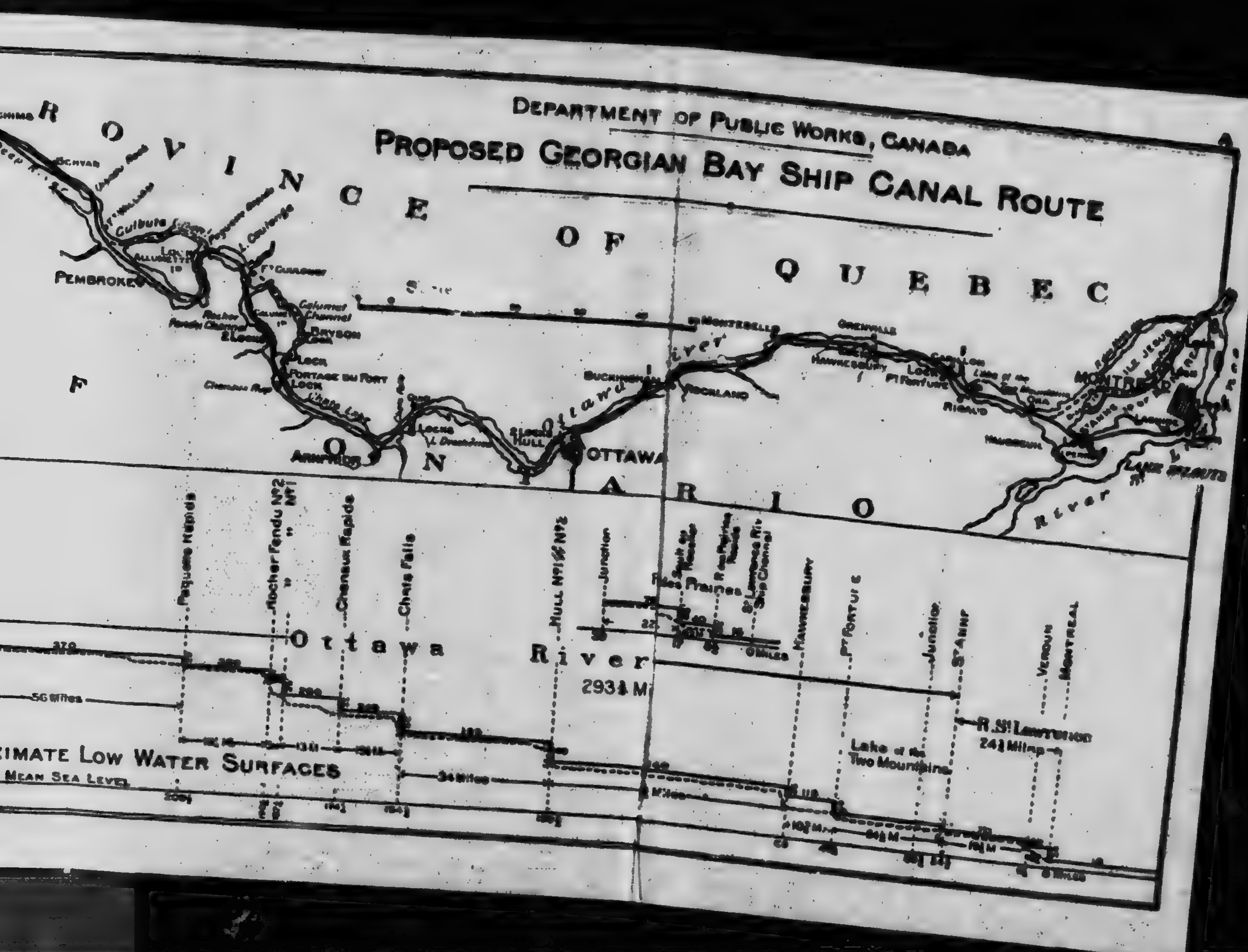
Canadian Lock, 900 feet long, 60 feet wide, nominal depth, 22 feet. Opened 1895.

Aggregate cost of United States and Canadian Locks to date, about $11,000,000.

Revenue: None, free of tolls.

		Tons.
Traffic	1881	1,567,714
	1887	5,494,649
	1897	18,982,755
	1907	58,217,214


Summit Water-Shed
NORTH BAY
342 Sq. Miles
LAKE NIPISSING
Ottawa
MATTAWA
DEUX RIVIERES
DES JOACHIMS
French River
Chaudiere Falls
FRENCH RIVER
GEORGIAN BAY
P R O V I N C E O
This part diverted into Feeder Canal 305 Sq. Miles
French River Village
Dalles Rapids
Five Mile Rapids
Chaudiere Falls
North Bay
Paresseux Falls
Les Epines Rap.
Plain Chant Chute
MATTAWA
Deux Rivieres
Rocher Capitaine
Des Joachims
Georgian Bay
French River
63 Miles
L. Nipissing
19½ Miles
Summit
24½ Miles
Mattawa R.
14⅜ Miles
Ottawa River
37 Miles
32 Miles
24½ Miles
440 MILES
403
PROPOSED RAISED WATER AND APPROXIMATE



DEPARTMENT OF PUBLIC WORKS, CANADA
PROPOSED GEORGIAN BAY SHIP CANAL ROUTE
PROVINCE OF QUEBEC
PROVINCE OF ONTARIO
PEMBROKE
BRYSON
PORTAGE DU FORT
ARNPRIOR
HULL
OTTAWA
BUCKINGHAM
ROCKLAND
MONTEBELLO
GRENVILLE
HAWKESBURY
CARILLON
RIGAUD
MONTREAL
LAKE ST. LOUIS
Ottawa River
Paquette Rapids
Rocher Fendu
Chenaux Rapids
Chats Falls
Hull
Junction
Hawkesbury
Pt Fortune
St Anne
Verdun
Montreal
Ottawa River 293½ M
Lake of the Two Mountains
R. St Lawrence
56 Miles
34 Miles
APPROXIMATE LOW WATER SURFACES
MEAN SEA LEVEL

Des Joachims
Deux Rivieres
Mattawa
Ottawa River
Mattawa R.
Summit
24 Miles
North Bay
PROPOSED RAISED WATER AND APPROXIMATE
DATUM : MEAN SE